CONTEXTUAL INFLUENCES ON THE USE OF HEALTH FACILITIES FOR CHILDBIRTH IN AFRICA

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ABSTRACT

Studies of maternal health seeking behaviour have focused on individual and household level factors. This analysis examines community level influences on the decision to deliver a child in a health facility across six African countries. Demographic and Health Survey data are linked with contextual data, and multilevel models are fitted to identify the determinants of childbirth in a health facility in the six countries. There are strong community level influences on a woman's decision to deliver her child in a health facility. Several pathways of influence between the community and individual were identified. Community economic development, the climate of female autonomy, service provision and fertility preferences all exert an influence on a woman's decision to seek care during labour, although significant community variation remains unexplained.

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Contextual influences on the use of health facilities for childbirth in Africa

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Introduction

According to the World Health Organization, approximately half a million women die each year due to complications in pregnancy or childbirth, and the level of maternal mortality is disproportionately high in Africa with a regional Maternal Mortality Ratio of 1000 per 100,000 live births (1). The majority of maternal deaths occur during childbirth, and the presence of trained medical staff has the potential to substantially reduce the number of maternal deaths (2). There thus exists the need to understand the factors that encourage childbirth in a health facility attended by a trained medical professional. Previous studies have approached this issue by examining individual and household level influences on the decision to deliver a child in a medical institution (3, 4, 5), yet the role of community factors in this decision have been largely ignored. Recent years has witnessed a growing recognition of the importance of contextual influences on health outcomes and in particular several studies have found significant effects of community level factors on reproductive health outcomes (6,7,8,9). Furthermore the application of multilevel modelling techniques has shown that spatial variations in reproductive health outcomes remain after controlling for individual and household factors (10, 11). This study examines the influence of individual, household and community level factors on the decision to deliver a child in a health facility in six African countries, extending upon previous studies by including the role of the community in the analysis.

Background

Community influences on health

Recently there has been growing interest in examining community influences on health outcomes, so as to put health in its socioeconomic environment (see for example 12-23), a product of the recognition that the determinants of individual health extend beyond individual and household risk factors. Such studies relate individual health outcomes to socioeconomic characteristics of the community (e.g. levels of economic development) and the community health infrastructure (e.g. presence and quality of health services). The development of multilevel modeling techniques has created a mechanism for measuring the influence of community factors and unobserved community effects on health outcomes, whilst providing a robust method for analyzing hierarchically clustered data (24-27). The incorporation of the role of the community in the analysis of health outcomes provides an opportunity to highlight health risks associated with particular social structures and community ecologies, providing a policy tool for the development of public health interventions (24, 28).

In the context of reproductive health, studies of community effects have focused predominantly on fertility behavior (see for example, 12, 13, 14, 21, 29), although some studies have examined maternal health outcomes (6, 18). Results indicate that the presence and quality of reproductive health services (13, 14, 21), levels of economic development (14, 21), levels of school participation (21), economic roles of children (6, 29), and community fertility norms (30, 31) all influence individual reproductive behavior. These studies have examined community influences on reproductive health in single country settings, and there is a dearth of studies that have

quantified and compared community influences on health outcomes across several countries. Additionally, such studies have focused on one aspect of the community as an influence on health outcomes. This paper extends on previous research by taking a multi-dimensional view of the community and examining a range of community influences on the decision to deliver a child in a health facility in six African countries.

Childbirth in a health facility

The choice of place of delivery has consistently been found to be associated with maternal and neonatal outcomes (32-34). Childbirth in a medical institution assisted by trained medical staff has been shown to be associated with lower rates of maternal and neonatal mortality and morbidity than home births (2, 35, 36). Given the demonstrated health benefits of institutional deliveries it is necessary to understand the range of factors associated with the decision to seek care during delivery, and to understand the role that the community has in influencing this decision.

Previous studies of health seeking behavior have focused largely on the barriers and facilitators in the decision to seek health care. Studies of health care utilization have highlighted a range of potential influences on a woman's propensity to seek health care. Demographic factors that have been shown to increase the likelihood of health service use are low parities (6, 37, 38), younger maternal age (37), women's employment in skilled work outside the home (39, 40) and high levels of husband's education (41) . Socioeconomic factors, however, have been shown to be of greater importance in determining health service utilization than demographic factors (42).

The most consistently found determinant of reproductive health service utilization has been a woman's level of educational attainment (6, 37, 39, 41) . It is thought that increased educational attainment influences service use by increasing female decision-making power, increasing awareness of health services, changing marriage patterns and creating shifts in household dynamics (43). Cost has often been shown to be a barrier to service utilization (44) and also influences the source from which care is sought. Socioeconomic indicators such as urban residence (39), household living conditions (44) , household income (38) and occupational status (41) have also proven to be strong predictors of a woman's likelihood of utilizing reproductive health services.

Both demographic and socioeconomic determinants of reproductive health care utilization are mediated by cultural influences on health seeking behavior that shape the way an individual perceives their own health and the health services available (46). These community beliefs and norms relating to health behaviors are reflected in the health decisions made by individuals, such that individual behavior is influenced by how a person thinks the community views their actions (46). For example, traditional beliefs surrounding childbirth coupled with misconceptions and fears of medical institutions have acted to maintain the reliance on home births in India (45). Results from a study in Benin found that women giving birth unassisted were *silently admired* (47), and in West Africa childbirth is considered a *woman's battle* (48). Thus, although demographic and socioeconomic factors are key determinants on health service utilization, the cultural environment in which the individual exists provides a strong influence on the extent to which these factors can lead to the utilization of health services.

Previous studies have thus highlighted a range of factors associated with a woman's decision to seek care during labor; however the role of the community has been largely ignored. There are several pathways through which a community has the potential to influence the health of an individual. Community beliefs and norms relating to health behaviors are a strong influence on the health care decisions made by individuals (46). The level of community economic development may influence health directly, through an association between deprivation and poor health (49), and indirectly through access to health services and social support systems (50). Economic development is also positively related to health outcomes due to its relationship with increased female decision-making power, through an increased likelihood of female labor force participation, and positive attitudes towards health service use (12). This paper examines the numerous ways that the community can influence a woman's decision to deliver her child in a health facility, providing an insight into the role of the community in individual behavior and contrasting this across six African countries.

Data

Six African countries were selected for analysis, divided into two regions: West; Ivory Coast, Burkina Faso, Ghana, and East; Kenya, Malawi and Tanzania. The selection of neighboring countries allows the identification of spatial variations in childbirth at a health facility that may transcend political boundaries. The selection of the countries was also informed by the availability of data that contained Global Positioning System (GPS) data that allows the mapping of the communities sampled. The data used in this analysis are from the Demographic and Health Surveys (DHS)

conducted in the six study countries (Kenya 1998, Malawi 2000, Tanzania 1999[1], Burkina Faso 1998, Ivory Coast 1998 and Ghana 1998). The DHS use a stratified multi-stage cluster sample design to collect nationally representative samples of women of reproductive age (15-45). Questionnaires are conducted with all eligible women (15-45) in each sampled household, collecting data on fertility, family planning, and health care seeking during pregnancy, in addition to demographic and socioeconomic data. Full descriptions of the study designs used in each country can be found at http://www.measuredhs.com/. In addition, each of these data sets collected Global Positioning System (GPS) locators for each of the Primary Sampling Units (PSU) included in the samples (51).

The samples for analysis are women of reproductive age who had a birth in the three years prior to the survey, resulting in sample sizes of Burkina Faso 3, 167, Ghana 1, 785, Ivory Coast 1, 131, Kenya 3, 058, Malawi 6, 318, and Tanzania 1, 710. The DHS data provide the individual and household level data for the analysis. Two approaches are used to obtain community data for the analysis. Some community factors are taken from the DHS data; this entailed averaging individual data to the PSU level (the PSU denotes the community in this analysis) thus producing derived community level factors. Secondly, data were obtained from GIS maps: rainfall (UNEP), habitat (ArcView World Map - © ESRI International), road and rail network data from the Digital Chart of the World, ArcView 8.2 (© ESRI International). International and sub-national boundary data were obtained from the African Population Database (© National Centre for Geographic Information and Analysis, University of California)

[1] The data set for Tanzania is the Reproductive and Child Health Survey 1999

Method

The dependent variable for analysis is a binary variable coded one if the woman delivered her last child in a health facility (including public and private facilities). Each of the DHS data sets has a hierarchical structure, with women nested within households and households within PSUs, thus violating the assumption of independence of ordinary logistic regression models. A multilevel modelling technique was employed to account for the hierarchical structure of the data and to facilitate the estimation of community (PSU and district) level influences on the outcome. The multilevel modelling strategy accommodates the hierarchical nature of the data and corrects the estimated standard errors to allow for clustering of observations within units (26). Multilevel models allow the identification of clustering in the outcome (also known as the random effect) which represents the extent to which the outcome of interest varies between each level of interest (PSU or district). A significant random effect may represent factors that influence the outcome variable that cannot be quantified in a large scale social survey (e.g. variation in health beliefs). A random effects model thus provides a mechanism for estimating the degree of correlation in the outcome that exists at the community level (PSU or district), while also controlling for a range of individual and household level factors thought to influence the outcome. Separate multilevel logistic models are fitted for each of the six countries. Two levels of variance are considered, the PSU and the district. The models are written:

$$Y_{ijk} = \pi_{ijk} + \varepsilon_{ijk} Z_{ijk}$$

where $\log_e(\pi_{ijk}/(1-\pi_{ijk})) = \alpha + \beta X_{ijk}^T + U_{jk} + V_K$, Y_{ijk} is a binary outcome (use of health facility at childbirth)for individual *i* in PSU *j* in district *k* , Y_{ijk} are assumed to be independent Bernoulli random variables with the probability of use of health facility for childbirth $\pi_{ijk} = \Pr(Y_{ijk} = 1)$. Consequently, to correctly specify the binomial variation, Z_{ijk} denotes the square root of the expected binomial variance of π_{ijk} and the variance of the individual residual term ε_{ijk} is constrained to be one. The outcome variable $\log_e(\pi_{ijk}/(1-\pi_{ijk}))$ fitted in the model is the $\log_e$ odds of use versus non-use. This constrained the predicted values from the model to be between zero and one. α is a constant, whilst β is the vector of parameters corresponding to the vector of potential explanatory factors defined as X_{ijk}. The PSU (level 2) residual term is defined as $U_{jk} \sim N(0, \sigma_u^2)$ and the district (level 3) residual term is defined as $V_k \sim N(0, \sigma_v^2)$.

The variables to be entered into the models are grouped into individual / household and community variables: the same independent variables are entered into the models for all six countries. The choice of individual and household independent variables is informed by previous studies on the factors influencing the decision to deliver a child in a health facility; maternal age, parity, marital status, place of residence, education, religion, previous exposure to health services and media messages, and an index of household amenities . The index includes the household drinking water source, toilet facility, and flooring material. Table 1 shows the variables used in the final models.

Several contextual influences on delivery in a health facility were considered in the original analysis design. It was intended to measure the health service environment, physical infrastructure and prevailing cultural beliefs surrounding health care seeking. However, it proved difficult to obtain contextual data from many of the study settings, and often indicators were measured differently across the six countries, limiting the amount list of standardized available contextual level data that was available. Some contextual variables that were available for all countries proved not to be significantly related to the outcome, these were; the transport infrastructure in the district (km per 1000 km2), the habitat type (forest / grassland), the predominant religion in the community, and the percentage of women in the community who desired to be tested for HIV. The paper thus presents only the contextual variables that were significant in at least one of the models. The contextual variables used in the final models are as follows. The mean number of children per woman in each PSU is used as a measure of traditional pro-natalist community attitudes. The percentage of husbands in the PSU who approve of family planning and the percentage of women in the PSU with secondary or higher education are entered to measure community attitudes towards women's roles. The mean number of women in each PSU who have delivered at least one previous birth in a health facility is used a measure of both the presence of services and of community attitudes towards the utilization of health services. Finally, the rainfall category of each PSU is used as an approximation of accessibility to services, with the assumption that services in places with poor infrastructures are harder to access during times of high rainfall.

Results

Tables 2 and 3 show the results of the multilevel logistic models of the decision to deliver a child in a health facility in the six African countries. In terms of individual variables, few variables proved to be significantly associated with the decision to deliver a child in a health facility in all six countries. The age of the respondent showed a significant association with the outcome in Malawi, Tanzania and Kenya, but was not significantly associated with the decision to deliver a child in a health facility in Burkina Faso, Ivory Coast or Ghana. Relative to women aged 20-29 at the time of the survey, in Malawi and Tanzania women of all ages groups were more likely to have delivered their last child in a health facility (Malawi 10-19 OR 1.22, 95CI 1.12-1.33, 30-39 OR 1.27 95CI 1.15-1.39, 40-49 OR 1.41 95CI 1.19-1.67; Tanzania 10-19 OR 1.64, 95CI 1.33-2.03, 30-39 OR 1.68 95CI 1.37-2.06, 40-49 OR 1.95 95CI 1.32-2.88). In Kenya women aged 30-39 (OR 1.36 95CI 1.16-1.60) and women aged 40-49 (OR 1.85 95CI 1.36-2.53) were more likely than women aged 20-29 to have delivered their last child in a health facility. Relative to women at parity 1-2, women at all higher parities were less likely to have delivered their last child in a health facility in all countries except Burkina Faso and Ivory Coast (Malawi parity 3-4 OR 0.78 95CI 0.72-0.84, parity 5+ OR 0.72 95CI 0.64-0.81; Tanzania parity 3-4 OR 0.47 95CI 0.39-0.58, parity 5+ OR 0.44 95CI 0.35-0.57; Kenya parity 3-4 OR 0.52 95CI 0.46-0.60, parity 5+ OR 0.37 95CI 0.30-0.44; Ghana parity 3-4 OR 0.59 95CI 0.49-0.72, parity 5+ OR 0.46 95CI 0.36-0.60). Mixed results were found in the association between maternal education and the decision to deliver the last child in a health facility. In Malawi, Kenya, Burkina Faso and Ghana women with secondary education or above were more likely than women with no education to have delivered their last child in a medical facility (Malawi OR 1.95 95CI 1.67-2.28; Kenya OR 2.75

95CI 0.23-3.40; Burkina Faso OR 2.94 95CI 1.68-5.14; Ghana OR 1.61 95CI 1.32-1.96). However, in Tanzania only women with primary education were more likely than women with no education to have delivered their last child in a medical facility (OR 1.59 95CI 1.33-1.90) and there was no association with maternal education in Ivory Coast.

With the exception of Burkina Faso, there was a linear relationship between the household amenities index and delivery in a health facility in all countries. Relative to women living in households with a high asset index score, women in all other categories of the index were less likely to report delivering their last child in a health facility (Malawi none OR 0.36 95CI 0.30-0.42, low OR 0.46 95CI 0.40-0.53, medium OR 0.51 95CI 0.45-0.59; Kenya none OR 0.15 95CI 0.11-0.20, low OR 0.33 95CI 0.28-0.39, medium OR 0.50 95CI 0.43-0.58; Tanzania none OR 0.42 95CI 0.28-0.65, low OR 0.51 95CI 0.39-0.67, medium 0.54 95CI 0.42-0.68; Burkina Faso none OR 0.85, 95CI 0.55-1.31, low OR 0.56 95CI 0.42-0.75, medium OR 0.65 95CI 0.48-0.88; Ghana none OR 0.31 95CI 0.17-0.56, low OR 0.52 95CI 0.40-068, medium OR 0.61 95CI 0.51-0.73; Ivory Coast none-low OR 0.28 95CI 0.13-0.59, medium OR 0.62 95CI 0.40-0.95).

In Ivory Coast women in polygamous marriages (OR 0.48 95CI 0.36-0.62) and women who were separated (OR 0.55, 95CI 0.35-0.86) and in Kenya women who were never married (OR 0.78 95CI 0.66-0.92) and women who were separated (OR 0.72 95CI 0.59-0.89) were less likely to report having their last child in a health facility than women in monogamous marriages. In Ghana Muslim women (OR 0.53

95CI 0.40-0.71) or women reporting another religion (OR 0.41 95CI 0.31-0.53) were less likely to report delivering their last child in a health facility than Catholic women, while in Kenya and Tanzania Protestant women were more likely to report delivering their last child in a health facility than Catholic women (Kenya OR 1.25 95CI 1.00-1.26, Tanzania OR 1.37 95CI 1.10-1.70). Women who reported having being exposed to family planning messages in the media were more likely to report delivering their last child in a health facility in Malawi (OR 1.38 95CI 1.29-1.48), Kenya (OR 1.20 95CI 1.08-1.33) and Tanzania (OR 1.33 95CI1.14-1.54).

Urban residence increased the likelihood of a woman reporting that her last child was delivered in a health facility in Malawi (OR 1.42 95CI 1.23-164), Tanzania (OR 1.97 95CI 1.51-2.57) and Ghana (OR 3.10 95CI 2.47-3.89). The only individual variables that were significantly associated with the reporting of the delivery of the last child in a health facility in all countries were the receiving of prenatal care during the last pregnancy and the reporting that a previous birth had been delivered in a health facility. Relative to women who had received 1-3 prenatal care visits in their last pregnancy, women who had received 4 or more prenatal care visits showed an increased likelihood of also reporting that their last child was born in a health facility in all six countries (Malawi OR 1.26 95CI 1.19-1.34; Tanzania OR 2.67 95CI 2.64-3.15; Kenya OR 1.61 95CI 1.45-1.80; Burkina Faso OR 1.66 95CI 1.45-1.89; Ghana OR 3.92 95CI 3.30-4.65; Ivory Coast OR 1.53 95CI 1.25-1.88). Women who had no prenatal care were significantly less likely to report delivering their last child in a health facility in Malawi (OR 0.13 95CI 0.10-0.17), Kenya (OR 0.66 95CI 0.50-0.86), Tanzania (OR 0.37 95CI 0.18-0.78), Ghana (OR 0.49 95CI 0.33-0.71) and Ivory Coast (OR 0.20 95CI 0.10-0.42). In all countries, women who had delivered a

previous child in a health facility were significantly more likely to report delivering their last child in a health facility (Malawi OR 2.61 95CI 2.43-2.80; Tanzania OR 2.92 95CI 2.46-3.46; Kenya OR 2.01 95CI 1.63-2.48; Burkina Faso OR 3.87 95CI 3.33-4.50; Ghana OR 2.68 95CI 2.17-3.31; Ivory Coast OR 7.71 95CI 5.75-10.35).

The results for the contextual variables varied across the six countries. A significant positive association between the percentage of women in the PSU with secondary education or higher was found in Malawi (OR 10.19 95CI 6.54-15.87), Kenya (OR 6.24 95CI 4.14-9.42) and Ghana (OR 2.37 95CI 1.53-3.65).A significant positive association was also found with the percentage of women in the PSU who had delivered at least one previous birth in a health facility in Malawi (OR 9.59 95CI 7.42-12.39), Tanzania (OR 6.34 95CI 3.48-11.50), Burkina Faso (OR 65.23 95CI 36.0-118.5), Ghana (OR 5.57 95CI 3.48-8.90) and Ivory Coast (OR 12.07 95CI 4.68-31.12). The percentage of husbands in the PSU who approve of family planning showed a significant positive association with the reporting that the last child was delivered in a health facility in Tanzania (OR 4.44 95CI 2.64-7.45) and Kenya (OR 2.66 95CI 1.88-3.77). The mean number of children per woman in the PSU showed a significant negative association with the outcome in Tanzania (OR 0.51 95CI 0.43-0.60). In Kenya a significant association was found between the mean rainfall of the PSU and the woman's odds of reporting that her last child was delivered in a health facility (OR 1.06 95CI 1.04-1.09).

Despite the inclusion of the individual and contextual variables, significant PSU level variation exists in all six countries (Malawi Beta 0.27 SE 0.04; Tanzania Beta 0.37 SE

0.13; Kenya Beta 0.49 SE 0.10; Burkina Faso Beta 0.65 SE 0.14; Ghana Beta 0.54 SE 0.15; Ivory Coast Beta 0.71 SE 0.22). The district level variation, however, remains significant only in Kenya (Beta 0.40 SE 0.13) and Tanzania (Beta 0.28 SE 0.13). Thus the variables included in the models successfully explain the district level variation in the reporting of the delivering of the last child in a health facility in four of the six countries, yet are not successful in explaining variation at the lower level PSU in any of the six countries. Figures 1 and 2 show the changing level of PSU and district level variation with the inclusion of individual and then contextual variables into the models. It is apparent that significant variation exists at both levels with the inclusion of only individual level variables in the models, and the inclusion of the contextual variables acts to significantly decrease the degree of variation at both levels.

The maps in figures 3 and 4 show the variations in health facility use for childbirth in East and West Africa. The map on the left shows the weighted raw data, the percentages of women in each district who report delivering their last child in a health facility. All six countries show a substantial variation in the outcome. In West Africa there is less variation in the percentage of women delivering their last child in a health facility. The maps on the right plot a comparison between actual use and the level of use predicted by the models. The level three residuals (district level) are used to calculate the predicted level of use in each district given the individual variables included in the models, and the residual variation is then calculated by comparing actual levels of use from the DHS data to the level of predicted use, such that lower than predicted use means that the level of use in a district is greater than 1.96 standard deviations from that predicted by the models. The maps show the remaining variation unaccounted for by individual level factors that are mostly accounted for by the

community factors. In East Africa areas of central Kenya, the Shihyanga and Der es Salaam provinces of Tanzania, and Mzimba and Bilantyre provinces of Malawi show higher use of health facilities for childbirth than predicted by the individual factors. Conversely, parts of central Malawi, southern Tanzania and Kenya display lower than predicted use. In West Africa Burkina Faso and Ghana display generally higher levels of health service use than predicted by the individual factors.

Discussion

The results demonstrate the impact of individual, household and community level influences on the decision to deliver a child in a health facility. The significant individual level factors reflect relationships identified in previous studies. Maternal age, parity, educational status, religion and marital status were all influential in a woman's decision to deliver her last child in a health facility, although the pattern and magnitude of these relationships varied across the six countries, indicating geographic and cultural variations in the pathways through which these variables influence health behavior. The significance of urban residence in four countries highlights the benefits in terms of greater service availability afforded to urban residents. Two variables were consistently related to the decision to deliver a child in a health facility in all six countries: the receiving of prenatal care and the delivery of a previous child in a health facility. The latter demonstrates a simple relationship; women who have delivered a child in a health facility are the most likely to continue to deliver future children in health facilities, irrespective of maternal age and parity. The significant effect of pre-natal care points to the role that care during pregnancy has in informing women of the benefits of institutional deliveries and in connecting women to appropriate services. The result also highlights a selectivity effect; the characteristics

that predispose women to seek pregnancy care also make them more likely to seek care during labor. There is obviously an influence of previous exposure to maternal health care services on a woman's decision to seek care during pregnancy, suggesting that other reproductive health services can be used as an opportunity to inform women of the benefits of institutional deliveries. The variables measuring previous exposure to maternal health services are also likely to reflect the availability of such services in the community.

The main focus of this research is on the role of community level factors on the decision to deliver a child in a health facility, and the results point to several pathways through which the community can influence individual behavior. The significant effect of the percentage of women in the community with secondary education and above in Malawi, Kenya and Ghana points to two potential pathways of influence: the role of community economic development and the influence of community attitudes to female roles. In less developed societies such as those analyzed here, levels of female education are often low, and the attainment of education of secondary level or above often reflects higher socioeconomic status. Hence, communities in which a higher percentage of women are achieving these levels of education are likely to be communities with higher percentages of socioeconomically advantaged households. Greater household wealth may enable women to seek care during pregnancy, with the costs of seeking care acting as a significant barrier to women from poorer households. Higher levels of female education in the community may also point to greater awareness of the need for care during childbirth. Although the content of formal education may not include health information, higher levels of education may create a greater awareness of health services and the need for care.

In more traditional societies, higher levels of female education may also indicate greater female autonomy, as education is often restricted to male children, and earlier ages at marriage and childbearing may restrict female access to higher levels of education. The positive association between the percentage of husbands in the community who approve of family planning and a woman's decision to deliver her child in a health facility also highlights the influence of female autonomy on health behavior. High levels of approval of family planning are associated with less conservative communities, which may also be less conservative in their attitudes towards women's roles. Hence, women living in communities with higher levels of female education and approval of family planning may also be living in climates of greater autonomy, allowing them greater decision-making power and the opportunity to seek care during pregnancy and labour. The significance of education at the individual and community levels suggests the importance of both individual autonomy and the climate of autonomy that exists in the community, and that the influences on individual health behavior extend to beliefs and practices of others in the community.

There was a strong positive influence of the percentage of women in the community who had delivered a child in a health facility on a woman's decision to seek care during labor in Malawi, Tanzania, Ghana, Burkina Faso and Ivory Coast, reflecting several possible pathways of influence. The high percentage of women in the community who had delivered their child in a hospital may simply reflect the presence of maternal health services in the community. Data was not available to measure the actual presence of health services, so this variable may be acting as a proxy for service availability. Previous studies have shown that women's decisions

surrounding health seeking are strongly influenced by the practices of others in the community (52), and thus in a community in which a high percentage of women are using health services for child birth the practice is likely to be seen as a norm, influencing individual behavior.

The mean number of children per woman in the community had a negative influence on a woman's decision to deliver her child in a health facility. Communities with higher fertility may be more conservative in their attitudes towards service use, the expected roles of women, and have a lower level of economic development, all of which have influences on a woman's ability to seek care during labor. High fertility may also reflect a lack of reproductive health services, and a lack of awareness of such services, both of which have obvious implications for maternal health service utilization.

After controlling for individual, household and community factors in the models, significant variation in the outcome still exists at the PSU level in all six countries, indicating that the models do not fully explain the community level variation in the decision to deliver a child in a health facility. This residual variation may be due to factors omitted from the models, or factors that cannot be measured in a large scale social survey. The latter may include cultural influences on service utilization, which are not only difficult to quantify, but may also vary across the six study settings. The community level education, family planning approval and fertility measures have captured some of these cultural influences, but others such as traditional views on childbearing are harder to record in a survey. The residual variation may also reflect

omitted factors, the most obvious been the presence of maternal health services in the community. Other factors that were not measured, but may have helped to reduce this variation, include the type and quality of health services and the financial accessibility of services. The models were, however, more successful in explaining district level residual variation, with significant variation remaining only in Kenya and Tanzania. It seems that the contextual variables chosen are more appropriate for explaining larger area variations, and that more research is needed to understand the factors influencing health behavior at the local community level. The maps shown in Figures 3 and 4 show that the actual levels of service use do not always match those predicted by the individual factors, indicating that although they act to highlight some of the main determinants of service use, they do not necessarily capture the range of community factors acting to influence the decision to deliver a child in a health facility.

Conclusion

This analysis has highlighted the range of influences on a woman's decision to deliver her child in a health facility, and has found many similarities in these influences across six African countries. A range of community level influences have been identified, and again these have been surprisingly similar across the six settings, illustrating the influence that indicators of community level socioeconomic development, female autonomy and fertility norms have on individual health seeking behavior. There is, however, sufficient variation in the significant community level variables between the six countries to suggest the need to examine the local cultural context when identifying community level interventions. The persistence of significant community level variation in the outcome illustrates two points: current social surveys are insufficient in measuring the range of cultural influences on health

seeking behavior, and that more research is needed to understand the dynamics of community influences on individual health.

From a methodological perspective this research has incorporated existing social survey data with contextual data to provide a fuller understanding of the determinants of the decision to utilize a health facility for childbirth, and has illustrated the role that GPS linked data has in explaining health behavior. However, the difficulties experienced in obtaining standardized contextual data from each of the countries points to the need to improve community level data collection techniques. From a public health perspective, this research has shown that the community plays an important role in shaping an individual's health behavior, and although we can identify some of the pathways of influence, there still remains much to be learnt of community level influences on health seeking in the contexts studied here. The latter illustrates the need for existing data sources to include more comprehensive community level data and for measures of community norms and practices to be included in the analysis of individual health seeking behavior. Community level influences on health seeking behavior can be harnessed to develop community level health interventions, and this research has extended previous studies by incorporating GPS data into this process, yet more research is needed to understand the existing residual variation in a woman's decision to deliver her child in a child facility.

References:

1. WHO 2001. Maternal Mortality in 1995: Estimates developed by WHO, UNICEF, UNFPA.Pp. 56. Geneva, Switzerland.

2. Howlader. A.A, Kabir, M, and Bhuiyan, M.M. Health-seeking Behaviour of Mothers and Factors Affecting Infant and Child Mortality. *Demography India*. 1999; Jul-Dec; 28 (2), 225-238.

3. Amooti-Kaguna, B.and F. Nuwara. 2000. "Factors Influencing Choice of Delivery Sites in Rakai Disctrict of Uganda." *Social Science in Medicine* 50:203-213.

4. Griffiths, P.and R. Stephenson. 2001. "Understanding Users' Perspectives of Barriers to Maternal Health Care Use in Maharashtra." *Journal of Biosocial Science* 33:339-359.

5. Kyomuhendo, G.B. 2003. "Low Use of Rural Maternity Services in Uganda: Impact of Women's status, Traditional Belief and Limited Resources." *Reproductive Health Matters* 11(21):16-26.

6. Magadi, M.A., N.J. Madise, and R.N. Rodrigues. 2000. "Frequency and timing of antenatal care in Kenya: explaining the variations between women of different communities." *Social Science in Medicine* 51:551-561.

7. Pebley, A.R., N. Goldman, and G. Rodriguez. 1996. "Prenatal and Delivery Care and Childhood Immunization: Do Family and Community Matter?" *Demography* 33(2):213-247.

8. Stephenson, R.B and Tsui, A.O. 2003: Contextual Influences on Reproductive Wellness in Northern India. *American Journal of Public Health*, 93 (11), 1820-1829, November.

9. Stephenson, R.B and Tsui, A.O. 2002: Community Influences on Reproductive Health Service Utilisation in Uttar Pradesh, India. *Studies in Family Planning, 33 (4)* December.

10. Amin, S., A.M. Basu, and R. Stephenson. 2002. "Spatial Variation in Contraceptive Use in Bangladesh: Looking Beyond the Borders." *Demography* 39(2):251-267.

11. Madise, N.J.and I. Diamond. 1995. "Determinant of Infant Mortality in Malawi: An Analysis to Control for Death Clustering Within a Families." *Journal of Biological Science* 27(1).

12. Grady, W.R, Klepinger, D.H, and Billy, J.O.G. The influence of community characteristics on the practice of effective contraception. Family Planning Perspectives. 1993; 25:1: 4-11.

13. Chacko, E. Women's use of contraception in rural India: a village-level study. Health and Place. 2001; 7: 197-208.

14. DeGraff. D, Bilsborrow, R.E, and Guilkey, D.K. Community-level determinants of contraceptive use in the Philippines: a structural analysis. Demography. 1997; 34:3:385-398.

15. Manda, S.O.M. Unobserved family and community effects on infant mortality in Malawi. Genus. 1998; 54:1-2:143-164.

16. Matteson, D, Burr, J, Marshall, J. Infant mortality: a multilevel analysis of individual and community risk factors. Social Science and Medicine 1998; 47: 1841-1854.

17. Anderson, R. Mortality effects of community socioeconomic status. Epidemiology. 1997; 8; 42-47.

18. Pebley, A.R, Goldman, N, Rodriguez, G. Prenatal and delivery care and childhood immunization: do family and community matter? Demography 1996; 33:2: 213-247.

19. Congdon, P. The impact of area context on long term illness and premature mortality: an illustration of multilevel analysis. Regional Studies 1995; 29: 327-344.

20. Von Korff, M, Koepsell, T, Curry, S, Dieh, P. Multilevel research in epidemiologic research on health behaviors and outcomes. American Journal of Epidemiology 1992; 135: 1077-1082.

21. Entwisle, B, Casterline, J.B, Sayed, A.A. Villages as contexts for contraceptive behavior in rural Egypt. American Sociological Review 1989; 54: 6: 1019-1034.

22. Entwisle, B and Mason, W.M. Multilevel effects of socioeconomic development and family planning programs on children ever born. American Journal of Sociology 1985; 91: 3: 616-649.

23. Tsui, A.O. Community effects on contraceptive use. Pp 77-99 in: The collection and analysis of community data: Ed: John. B. Casterline. Voorburg, Netherlannds. International Statistical Survey. 1985.

24. Duncan, C., Jones, K., and Moon.G. Context, composition and heterogeneity: using multilevel models in health research. Social Science and Medicine. 1998; 46:1:97-117.

25. Diez-Roux, A.V. Investigating neighborhood and area effects on health. American Journal of Public Health 2001; 91:11: 1783-1789.

26. Goldstein, H. Multilevel statistical models. Edward Arnold, London.

27. DiPrete, T.A, Forrostal, J.D. Multilevel models: methods and substance. Annual Review of Sociology 1994; 20: 331-357.

28. Pickett, K.E and Pearl, M. Multilevel analysis of neighborhood socioeconomic context and health outcomes: a critical review. Journal of Epidemiology and Community Health. 2001; 55:111-122.

29. Hirschman, C and Guest, P. Multilvel models of fertility determination on four south-east Asian countries: 1970-1980. Demography 1990; 27:3: 369-396.

30. Dixon-Meuller, R. Gender inequalities and reproductive health: Changing priorities in an era of social transformation and globalization. Belgium, International Union for the Scientific Study of Population, 1999. (Policy and Research Paper No.16).

31. Greenwell, K.F. Contraceptive method mix menu: Providing healthy choices for women. World Health Statistics Quarterly 1996. 49:2: 88-93.

32. Giri, K . “Discussion.” *International Journal of Gynecology and Obstetrics*, 1995; 50, Suppl.2: S43.

33. Tsu, V. D. Antenatal Screening: Its Use in Assessing Obstetric Risk Factors in Zimbabwe. *Journal of Epidemiology and Community Health*, 1994; 48: 297-305.

34. Thaddeus, S., and Maine D. Too Far to walk: Maternal Mortality in Context. *Social Science and Medicine*, 1994; 38, 8: 1091-1110.

35. Luther, N.Y. Mother's Tetanus Immunisation is Associated not only with Lower Neonatal Mortality but also with Lower Early-childhood Mortality. *National Family Health Survey Bulletin*. No. 10. East-West Centre program on Population. Honolulu, 1998.

36. Jejeebhoy, S. J. and Rao, S. R. *Unsafe Motherhood: A Review of Reproductive Health*. in Das Gupta, M., Chen, L.C. and Krishnan, T. N. (eds) *Women's Health in India: Risk and Vulnerability*. Oxford University Press, Bombay, 1995.

37. Bhatia, J. & Cleland, J. 1995, "Determinants of Maternal Care in a Region of South India", *Health Transition Review*, vol. 5, pp. 127-142.

38. Kavitha, N. & Audinarayana, N. 1997, "Utilization and Determinants of Selected MCH Care Services in Rural Areas of Tamil Nadu.", *Health and Population - Perspectives and Issues*, vol. 20, no. 3, pp. 112-125.

39. Addai, I. 1998, "Demographic and Sociocultural Factors Influencing Use of Maternal Health Service in Ghana", *African Journal of Reproductive Health*, vol. 2, no. 1, pp. 73-80.

40. Estrin, D. J. 1999, "Reproductive Behavior is Linked to Work Autonomy, Not to Employment Itself", *International Family Planning Perspectives*, vol. 25, no. 1, pp. 50-51.

41. Nuwaha, F. & Amooti-kaguna, B. 1999, "Predictors of Home Deliveries in Rakai District, Uganda", *African Journal of Reproductive Health*, vol. 3, no. 2, pp. 79-86.

42. Obermeyer, C. M. & Potter, J. E. 1991, "Maternal Health Care Utilization in Jordan: A Study of Patterns and Determinants", *Studies in Family Planning*, vol. 22, no. 3, pp. 177-187.

43. Obermeyer, C. M. 1993, "Culture, Maternal Health Care, and Women's Status: A Comparison of Morocco and Tunisia", *Studies in Family Planning*, vol. 24, no. 6, pp. 354-365.

44. Bloom, S. S., Lippeveld, T., & Wypij, D. 1999, "Does Antenatal Care Make a Difference to Safe Delivery? A Study in Urban Uttar Pradesh, India", *Health Policy and Planning*, vol. 14, no. 1, pp. 38-48.

45. Basu, A. M. 1990, "Cultural Influences on Health Care Use: Two Regional Groups in India", *Studies in Family Planning*, vol. 21, no. 5, pp. 275-286.

46. Rutenberg, N. & Watkins, S. C. 1997, "The Buzz Outside the Clinics: Conversations and Contraception in Nyanza Province Kenya", *Studies in Family Planning*, vol. 28, no. 4, pp. 290-307.

47. Sargent, C. 1990. "The politics of birth; cultural dimensions of pain, virtue and control among Bariba of Benin." Pp. 111 in *Birth , Power, Social change and Politics of reproduction*, edited by P.H. W: Boulder: Western View Press.

48. Diallo, A.B. 1991. ""A Tora Mousso Kele La": A call beyond duty often omitted root causes of maternal mortality in West Africa." New York: UN Development Programme, HIV and Development Programme.

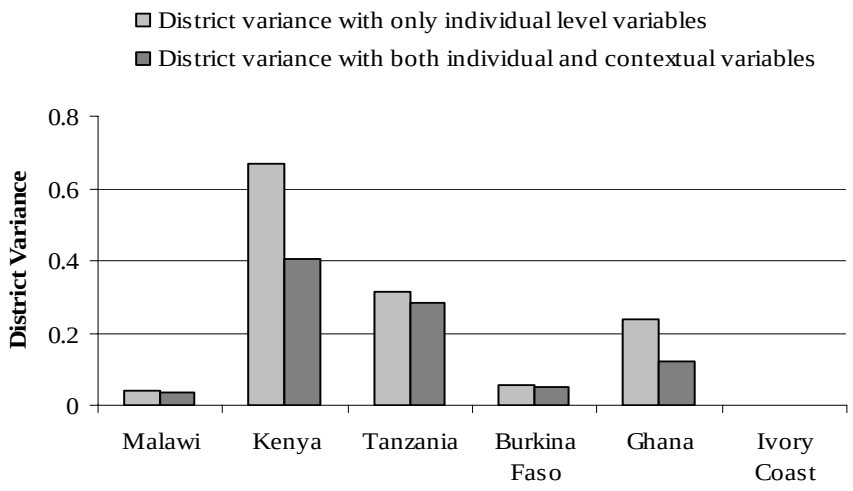
49. Kriegar, N., Rowley, D., & Herman, A. 1993, "Racism, Sexism and Social Class: Implications for Studies of Health, Diseases and Well-Being", *AmericanJournal of Preventative Medicine*, vol. 9, no. S2, pp. 82-122.

50. Diez-Roux, A. V. 1998, "Bringing Context Back into Epidemiology: Variables and Fallacies in Multilevel Analysis", *American Journal of Public Health*, vol. 88, pp. 216-222.

51. Montana, L.and J. Spencer. 2001. "Incorporating Geographic Information into MEASURE Surveys: A Field Guide to GPS Data Collection." Calverton, Maryland: Macro International.

52. Stephenson, R.B and Matthews, Z. 2004: Uptake of Maternal Health Care Services among Migrant and Non-Migrant Groups in Maharashtra, India. *Asia Pacific Population Journal*, Vol. 19 (1), 39-60.

Figure 1: District variation in the decision to deliver a child in a health facility across six African countries



Owing to the design of the survey, which included approximately 40% of the study population in one district, the district variation in the Ivory Coast was computed as zero

Figure 2: Community (PSU) variation in the decision to deliver a child in a health facility across six African countries

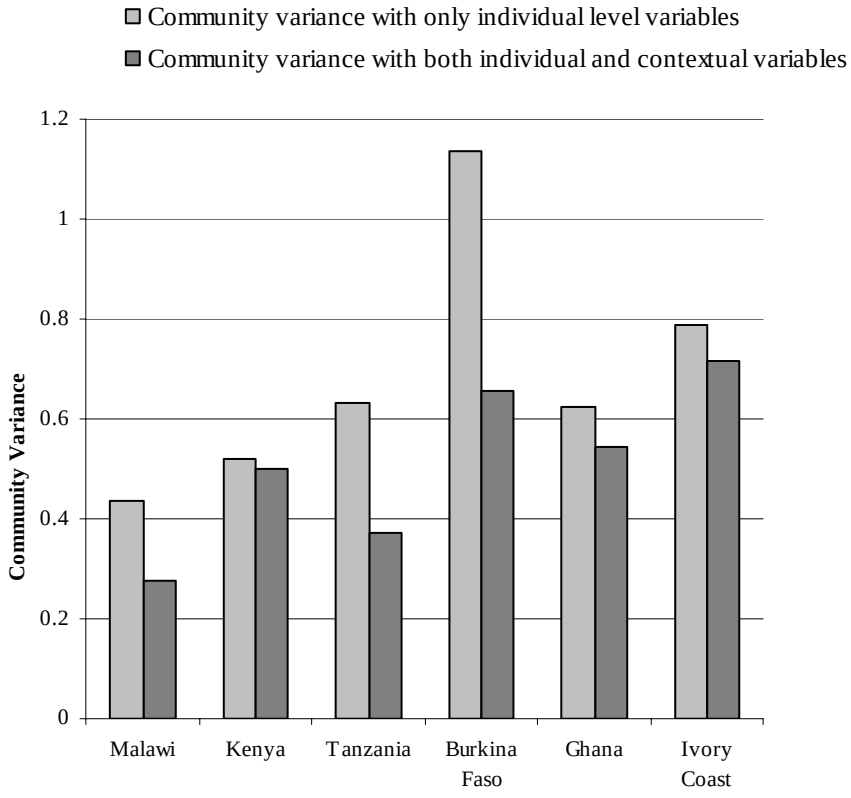


Figure 3: Actual and predicted levels of health facility use for child birth in East Africa

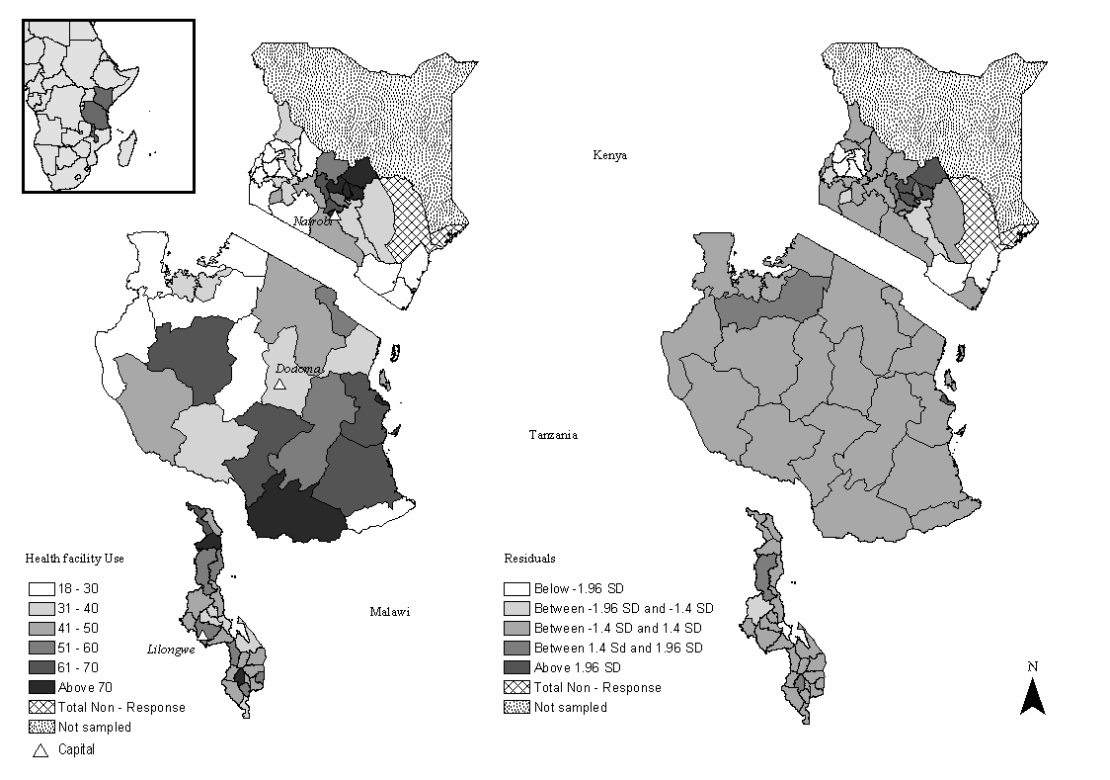


Figure 4: Actual and predicted levels of health facility use for child birth in West Africa

Table 1: Independent Variables used in Modeling of Delivery in a Health Facility

	Operational Definition
Individual and Household Variables	
Age of respondent	Self-reported age of respondent at time of survey: 10-19, 20-29, 30-39, 40-49
Parity	Number of children ever born; 1-2, 3-4, 5+
Marital status	Marital status at time of survey; monogamous, never married, formerly married, polygamous
Educational attainment	Highest level of education attained: none, primary, secondary or higher
Religion	Self reported religious group; Catholic, Protestant, Muslim, Other
Exposure to family planning information	Whether respondent has been exposed to family planning messages via radio, television or radio
Received prenatal care in last pregnancy	Whether the respondent received prenatal care in her previous pregnancy; no, 1-3 visits, 4+ visits, number of visits not known
Delivered previous birth in medical facility	Whether the respondent delivered her child previous to the index child in a health facility
Household asset index	A composite index of household amenities: drinking water, toilet facility and floor material
Urban residence	Current place of residence; urban or rural
Community Variables	
Mean number of children per PSU	The mean number of children ever born per woman in the PSU
PSU level approval of family planning	The percentage of husbands in the PSU who are reported by their wives to approve of the use of family planning
PSU level of female educational attainment	The mean number of years of female education per woman in the PSU
PSU level of maternal health service use	The percentage of women in the PSU who delivered their last child in a health facility
Rainfall category of PSU	Millimetres of average annual rainfall (32 categories)

Table 2: Multilevel Modeling of Childbirth in a Health Facility in Three East African Countries

	Malawi		*Kenya*		*Tanzania*	
	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval
Place of residence(rural)						
Urban	1.429	1.239-1.649	1.162	0.901-1.498	1.976	1.519-2.570
Age group(20-29)						
10-19	1.228	1.127-1.336	1.143	0.990-1.320	1.647	1.331-2.038
30-39	1.270	1.153-1.399	1.366	1.165-1.602	1.685	1.376-2.065
40-49	1.412	1.190-1.675	1.859	1.365-2.532	1.954	1.324-2.883
Parity(1-2)						
3-4	0.781	0.721-0.846	0.529	0.464-0.604	0.479	0.395-0.580
5+	0.725	0.645-0.814	0.372	0.309-0.447	0.448	0.353-0.570
Marital status(monogamous)						
Never married	0.982	0.807-1.195	0.785	0.664-0.929	1.078	0.789-1.473
Formerly married	1.125	1.017-1.245	0.729	0.593-0.897	0.881	0.689-1.125
polygamous	1.132	1.037-1.236	0.775	0.654-0.919		
Respondent's education(no education)						
Primary	1.087	1.012-1.166	1.137	0.944-1.369	1.594	1.334-1.904
Secondary / higher	1.952	1.670-2.282	2.754	2.230-3.401	1.162	0.859-1.571
Religion(catholic)						
Protestant	0.955	0.885-1.030	1.125	1.003-1.262	1.374	1.110-1.702
Muslim	0.898	0.800-1.007	0.732	0.548-0.978	1.275	0.613-2.654
Other	0.891	0.689-1.154	0.747	0.528-1.057	1.040	0.780-1.387
Exposure to PF information	1.385	1.297-1.480	1.203	1.084-1.335	1.334	1.149-1.548

Antenatal visit(1-3)						
None	0.136	0.107-0.173	0.661	0.508-0.861	0.375	0.180-0.781
4+	1.267	1.192-1.347	1.618	1.454-1.800	2.672	2.264-3.155
DK	1.045	0.769-1.420	3.658	2.537-5.275	1.527	0.811-2.872
Previous Birth in Hospital						
Yes	2.612	2.433-2.804	2.016	1.637-2.482	2.927	2.469-3.469
Household index(high)						
None	0.360	0.306-0.423	0.154	0.118-0.200	0.427	0.280-0.652
Low	0.466	0.407-0.534	0.334	0.284-0.394	0.516	0.393-0.678
Medium	0.519	0.456-0.592	0.502	0.431-0.584	0.540	0.429-0.680
Contextual variables:						
Mean number of children per PSU	0.901	0.827-0.982	0.943	0.855-1.040	0.512	0.431-0.609
Husband approval of Family Planning	1.355	1.018-1.804	2.667	1.887-3.770	4.442	2.646-7.456
Women with secondary and higher education in PSU(%)	10.196	6.547-15.879	6.246	4.141-9.422	1.754	0.711-4.328
Rainfall Category of PSU	1.007	0.983-1.031	1.067	1.044-1.091	0.987	0.971-1.003
Mean number of women in PSU who had at least one previous birth in health service	9.593	7.426-12.391	0.874	0.493-1.548	6.334	3.487-11.508
		SE		SE		SE
District Variance	0.035	0.020	0.405	0.136	0.282	0.139
PSU Variance	0.275	0.046	0.499	0.100	0.371	0.130

Table 3: Multilevel Modeling of Childbirth in a Health Facility in Three West African Countries

	Burkina Faso			*Ghana*			*Ivory Coast*	
		Odds Ratio	95% Confidence Interval		Odds Ratio	95% Confidence Interval		Odds Ratio	95% Confidence Interval
Place of residence	*(Ouagadougou)*			*(Rural)*			(Rural)		
	Other Cities-SFPS intervention	0.483	0.269-0.868	Urban	3.105	2.477-3.892	Abjadin-I	1.018	0.540-1.919
	Other Cities-NO intervention	0.435	0.170-1.110				Abjadin-NI	1.110	0.526-2.342
	Rural-SFPS intervention	0.102	0.051-0.206				Ville-I	1.632	1.070-2.489
	Rural-NO intervention	0.144	0.073-0.284				Villes-NI	1.327	0.855-2.061
Age group(20-29)									
10-19		1.267	1.052-1.527		1.315	1.055-1.639		1.493	1.148-1.943
30-39		0.858	0.717-1.027		1.323	1.078-1.624		1.523	1.135-2.044
40-49		0.888	0.661-1.192		1.531	1.064-2.203		2.291	1.266-4.145
Parity(1-2)									
3-4		0.992	0.847-1.162		0.599	0.499-0.720		0.684	0.522-0.897
5+		1.073	0.867-1.327		0.468	0.361-0.605		0.736	0.516-1.051
Marital status(monogamous)									
Never married		1.937	0.928-4.043		1.048	0.688-1.597		0.839	0.630-1.119
Formerly married		0.890	0.557-1.423		0.775	0.600-1.001		0.553	0.352-0.867
polygamous		0.955	0.843-1.082		0.862	0.712-1.042		0.480	0.368-0.625
Respondent's education(no education)									
Primary		0.890	0.699-1.134		0.910	0.745-1.113		1.384	1.097-1.745
Secondary / higher		2.945	1.687-5.140		1.614	1.328-1.962		1.426	1.035-1.966
Religion(catholic)									
Protestant		1.292	0.979-1.704		0.815	0.664-1.002		1.247	0.915-1.701
Muslim		1.158	0.977-1.373		0.538	0.407-0.713		1.289	0.982-1.692
Other		0.827	0.668-1.023		0.411	0.316-0.533		1.198	0.875-1.642
Exposure to PF information		1.195	1.047-1.363		1.311	1.126-1.527		1.054	0.858-1.296

Antenatal visit(1-3)						
None	10.580	8.645-12.949	0.489	0.335-0.714	0.206	0.100-0.423
4+	1.660	1.456-1.893	3.924	3.307-4.655	1.536	1.252-1.883
DK	3.525	2.147-5.789	5.590	3.219-9.708	1.861	0.656-5.280
Previous Birth in Hospital						
Yes	3.873	3.333-4.500	2.683	2.171-3.317	7.714	5.749-10.350
Household index(high)						
None	0.857	0.558-1.318	0.313	0.173-0.568	0.286	0.137-0.596
Low	0.563	0.421-0.754	0.528	0.404-0.689	0.286	0.137-0.596
Medium	0.656	0.489-0.880	0.614	0.512-0.738	0.622	0.407-0.950
Contextual variables:						
Mean number of children per PSU	1.063	0.883-1.279	0.851	0.748-0.969	0.919	0.716-1.178
Husband approval of Family Planning	0.898	0.461-1.749	1.018	0.693-1.496	1.150	0.564-2.344
Women with secondary and higher education in PSU(%)	20.532	3.800-110.941	2.373	1.539-3.658	2.370	0.884-6.353
Rainfall Category of PSU	1.003	0.968-1.040	0.936	0.861-1.018	1.241	0.946-1.629
Mean number of women in PSU who had at least one previous birth in health service	65.235	36.017-118.155	5.573	3.487-8.908	12.073	4.683-31.125
		SE		SE		SE
District Variance	0.049	0.061	0.123	0.085	0.000	0.000
PSU Variance	0.656	0.147	0.545	0.155	0.718	0.223